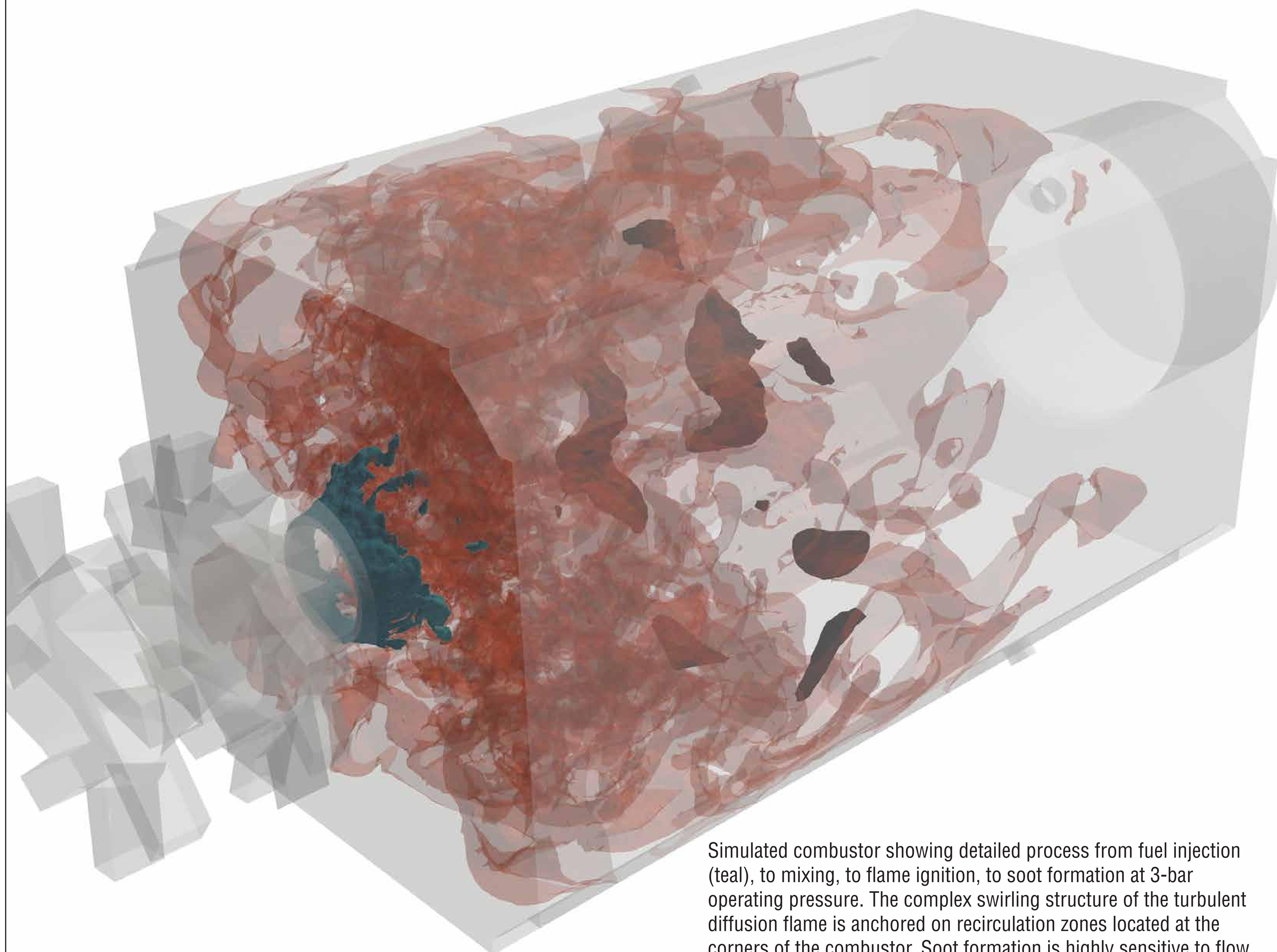
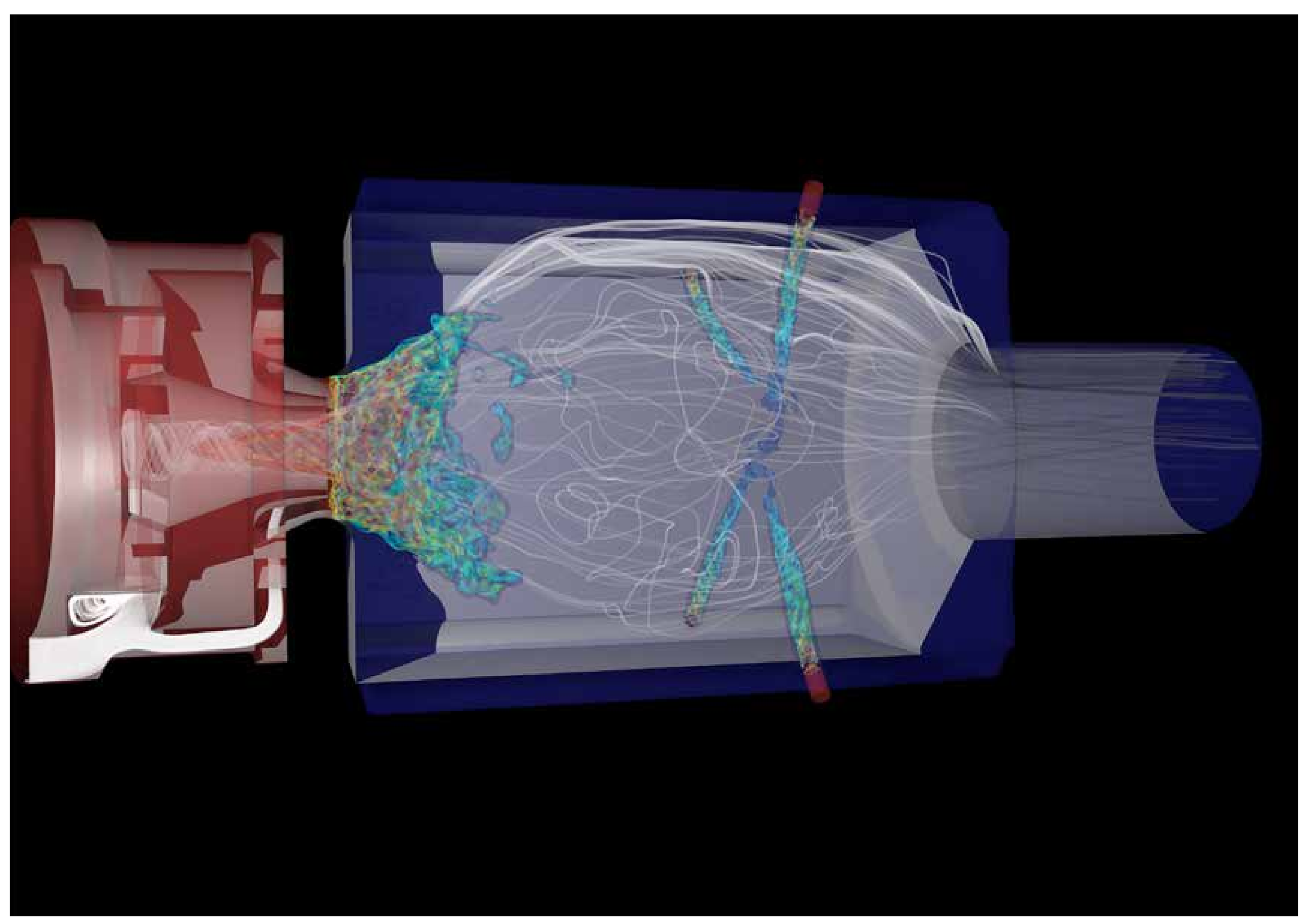


Simulated combustor showing detailed process from fuel injection (teal), to mixing, to flame ignition, to soot formation at 3-bar operating pressure. The complex swirling structure of the turbulent diffusion flame is anchored on recirculation zones located at the corners of the combustor. Soot formation is highly sensitive to flow strain rate, so the turbulent structure of the flame (orange) helps reduce soot formation, although soot pockets (dark spots) do appear intermittently. *Alex Chong, University of Michigan*



High-velocity, swirling air streams (multicolored contours) are injected into a simulated jet engine to enhance mixing and guide the flame. Secondary air jets are injected at a downstream location to dilute the post-combustion mixture and reduce soot formation. Recirculation in the center of the combustor, shown by the flow streamlines (white lines), is also critical to flame stabilization and soot reduction. *Alex Chong, University of Michigan*

National Aeronautics and
Space Administration

Reducing Soot Emissions from Jet Engines

Researchers in the Advanced Propulsion Concepts Lab (APCL) at the University of Michigan are simulating aero combustors to better predict soot emission and inform future jet engine design. These large eddy simulations are run on the Pleiades supercomputer using APCL's umFlameletSoot model, which fully couples fluid dynamics, combustion chemistry, soot particle dynamics, and radiation function to resolve microscale turbulent eddies and reveal the intermittent nature of soot agglomerates.

Results help answer fundamental questions about how soot forms, coagulates, and grows to form large agglomerate structures. The longer-term goal is to understand how to use aerodynamic straining to oxidize soot particles before they grow into larger particles—eventually helping to reduce soot emissions.

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